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动物分类学报

A NEW SPECIES OF CASCADE FROG (AMPHIBIA, RANIDAE) FROM TIBET, CHINA

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Abstract A new cascade frog, superficially resembling *Odorrana graminea*, *O. chloronota* and *O. livida* in having green color dorsally and ventral circummarginal grooves around the discs of the fingers, has been found in Mêdog County of Tibet (Xizang Autonomous Region), China. The new species (*Odorrana zhaoi*) is characterized by a combination of the following main attributes: 1) a golden upper lip strip from tip of snout and along the upper jaws extending to insertion of arm; 2) tympanum circular, very distinct and depressed with rim, TD : ED 0.56 in male; 3) dorsolateral fold weak, dorsum smooth except granular in posterior part, venter smooth except for a granular region under the thighs; 4) limbs with transverse bands of distinct blotches to tips of digits; 5) Tips of all fingers expanded with ventral circummarginal grooves, about 1.5 to two times the width of phalanges in figures **III** and **IV**; 6) inner metatarsal tubercle distinct and ovoid, no outer metatarsal tubercle; 7) feet fully webbed to disks; 8) male with velvety nuptial pad on thumb, paired external subgular pouches but no humeral glands, fine spinules in an ovoid cluster on throat and chest.

Key words Ranidae, *Odorrana*, new species, China.

1 Introduction

Tibet (Xizang) is an important part of two biodiversity hotspots of the world, the Himalaya Hotspot and Indo-Burma Hotspot, which were called the hottest of the hotspots (Mittermeter *et al.*, 1999), and the home to the highest mountains of the world. The mountains rise abruptly, resulting in a diversity of ecosystems that range from alluvial grassland and subtropical broadleaf forests to Alpine meadows above the tree line. This area also holds remarkable endemism and home to important populations of numerous amphibians and reptiles. The pioneering field survey leaded by Dr. Liu and Hu in last century has been making discoveries of more than ten new amphibian species up-to-now (Hu, 1987; Fei *et al.*, 2005; Li, 2007). In 2004, a program of herpetological survey of Tibet Plateau was sponsored and started up by Shenyang Normal University and IUCN-China Reptile and Amphibian Specialists Group. Among the collection of this survey, we got some important specimens and data (Li *et al.*, 2005; Zhao *et al.*, 2005; Yang, *et al.*, 2005). Despite this attention, this part of the fauna of Tibet is still imperfectly known.

The taxonomy at higher level within the family Ranidae are still problematic and uncertain (e. g. Inger, 1996; Jiang and Zhou, 2005; Chen *et al.*, 2005; Frost *et al.*, 2006; Ngo *et al.*, 2006). Several genera, such as *Rana*, *Amolops*, *Huia*, *Meristogenys*, *Hylarana*, and *Odorana* have been setup to include cascade ranids with grooved and expanded fingertips and some of the ranids were placed in these genera variously (Bain *et al.*, 2003).

Bain *et al.* (2003) made taxonomic revisions of the cascade frogs from Southeastern Asia and described six new species, and more than ten new species have been recorded from the area now (Bain *et al.*, 2003; Bain and Nguyen, 2004; Bain *et al.*, 2006; Orlov *et al.*, 2003; Stuart *et al.*, 2005).

Bain *et al.* (2003) designated a neotype of *Rana livida*, since no name-bearing type exists and its designation qualifies under the conditions of Article 75.3 of the Code (International Commission on Zoological Nomenclature, 1999). And they also removed *R. leporipes*, *R. sinica*, *R. graminea*, and *R. chloronota* from synonymy of *R. livida* because each is defined by distinct, diagnostic characters. They redescribed *R. sinica*, *R. graminea*, *R. chloronota*, and *R. livida*, and comment on *R. leporipes* (Bain *et al.*, 2003). These frogs are place under the genus *Odorrana* (Frost *et al.*, 2006; Frost, 2007).

After examination of specimens of *Odorrana livida*, *O. graminea* and *O. margaretae* collected from other parts of mainland China and comparison with works of Bain *et al.* (2003, 2006), we describe here a new species of cascade frog, which has remained hidden in collections and reported under the name *R. margaretae* by Zhao *et al.* (2005).

2 Materials and Methods

Specimens were preserved in 10% buffered formalin and later transferred to 70% ethanol. Tissue samples were taken from some individuals by preserving pieces of liver and/or muscle in 95% ethanol before the specimen

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was fixed in formalin. Specimens were deposited in Shenyang Normal University Museum of Natural History (SYNU).

Measurements were made with digital calipers to the nearest 0.01 mm and rounded to the nearest 0.1 mm. External measurements included snout-vent length (SVL), head length (HL) from tip of snout to rear of the jaws, maximum head width (HW), snout length (SL) from tip of snout to the anterior corner of the eye, diameter of the exposed portion of the eyeball (ED), internasal distance (IND), interorbital distance (IOD) at narrowest point, horizontal diameter of tympanum (TD), tympanum-eye distance (TED) from anterior edge of tympanum to posterior corner of the eye, tibia length (TL), femur length (FEM) from vent to outer edge of knee; hand length (HAL) from base of palm to tip of finger Ⅲ, foot length (FL) from proximal edge of inner metatarsal tubercle to tip of fourth toe, diameter of third figure disc (FD3), diameter of fourth toe disc (TD4).

In addition to the new species presented here, other ranid species from mainland Southeastern Asia with digit tips expanded with circummarginal grooves were used for comparision. Data for these frogs were taken from the original descriptions (Liu and Hu, 1961; Inger and Chanard, 1997; Fei and Ye, 2001; Bain *et al.*, 2003; Orlov *et al.*, 2003; Bain and Truong, 2004; Bain *et al.*, 2006) and examination of specimens (in Appedix) from Museum of Herpetology in Chengdu Institute of Biology (CIB), Museum of Animals in Kunming Institute of Zoology (KIZ) and SYNU.

Odorrana zhaoi sp. nov. (Figs. 1-2)

Holotype SYNU04II6222, adult male, collected at Yarang, Mêdog County, Tibet (Xizang Autonomous Region) at 767m (Zhao *et al.*, 2005), by RAO Ding-Qi and LÜ Shun-Qing, on 5 Aug. 2004.

Diagnosis. *Odorrana zhaoi* is characterized by a combination of the following attributes: 1) body dorsoventrally compressed; 2) a golden upper lip strip from tip of snout and along the upper jaws extending to insertion of arm; 3) tympanum circular, very distinct and depressed with rim, TD: ED 0.56 in male; 4) dorsolateral fold weak, dorsum smooth except granular in posterior part, flank granular and spinous, venter smooth except for a granular region under the thighs; 5) limbs with transverse bands of distinct blotches to tips of digits; 6) tips of all fingers expanded with ventral circummarginal grooves, about 1.5 to two times the width of phalanges in figures Ⅲ and Ⅳ; 7) feet fully webbed to disks; 8) inner metatarsal tubercle distinct and ovoid, no outer metatarsal tubercle; 9) male with velvety nuptial pad on thumb, paired external subgular pouches but no humeral glands, fine spinules in an ovoid cluster on throat and chest.

Etymology. The specific epithet honors Dr. ZHAO Da-Yu, Present of Shenyang Normal University, for his strong support to the survey in Xizang.

Description. Body moderately slender; head longer than width (HL:HW = 1.16); snout obtusely pointed, prominently projecting, round in profile, not depressed; nostril lateral, closer to tip of snout than to eye (1/3);

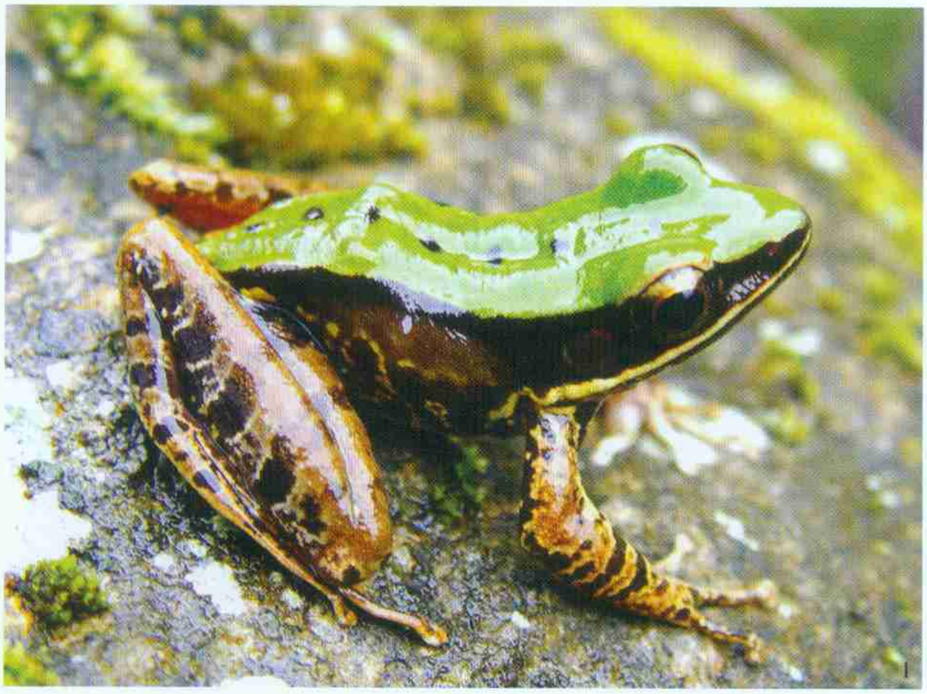
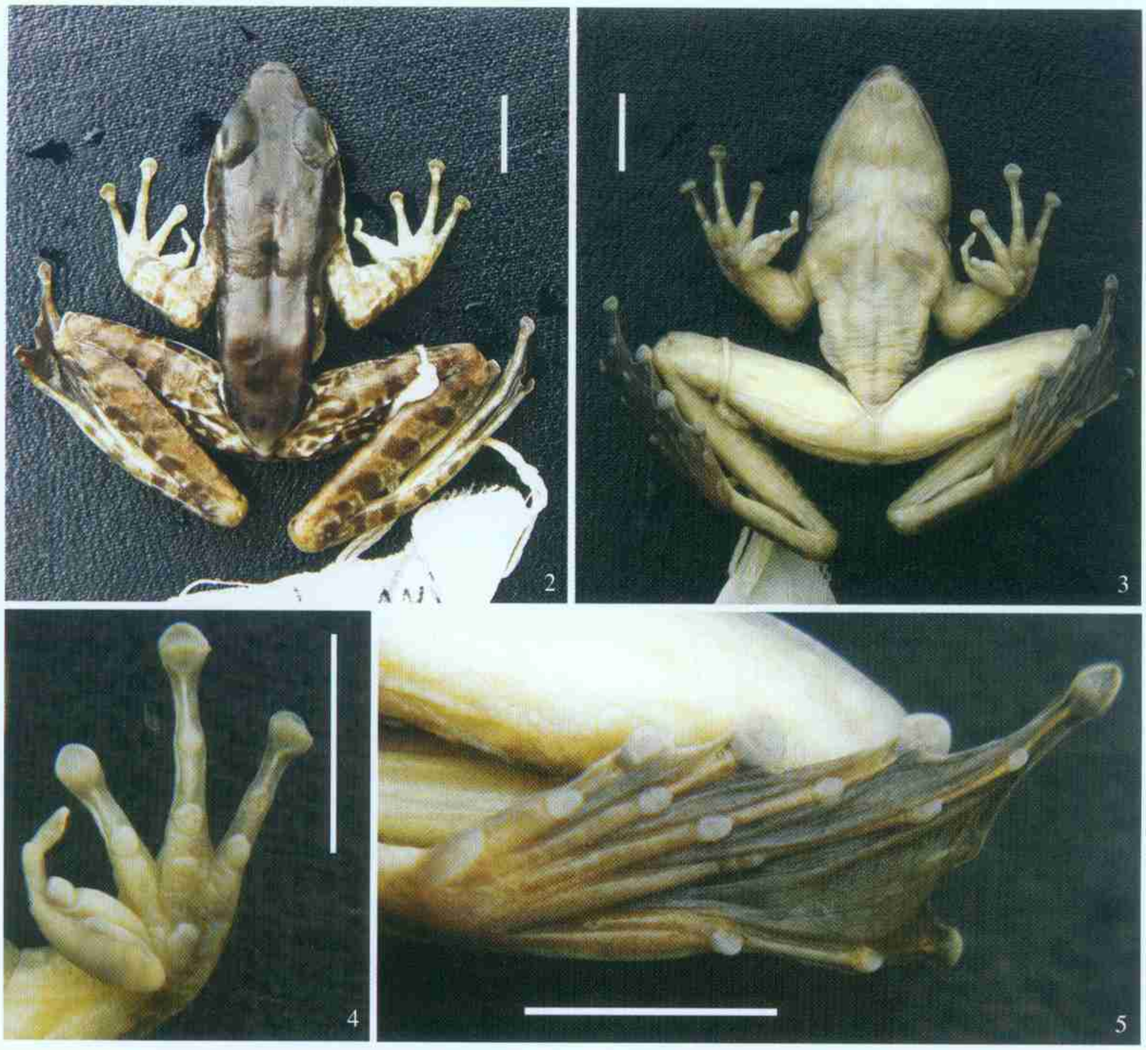


Fig. 1. *Odorrana zhaoi* sp. nov. (holotype)



Figs. 2-5. Holotype of *Rana zhaoi* (SYNU04II6222). 2. Dorsal. 3. Ventral view of body. 4. Palmar view of left hand. 5. Palmar view of left foot. Scale bars = 10 mm.

canthus slightly angular, not constricted; lores concave, weakly sloping; eye diameter shorter than snout; interorbital narrower than eyelid; round and distinct tympanum, depressed as concaving related to skin of temporal region, more than half-one diameter of eye, separated from eye by distance much less than tympanum diameter (TED∶TD = 0.28); tympanic rim prominent and evelated relatively to tympanum; choanae nearly round; vomerine teeth on two oblique ridges, slightly closer to each other than to choanae; tongue cordiform, notched posteriorly, free for approximately two-fifths its length.

Tips of all fingers expanded with ventral circummarginal grooves, about 1.5 to 2.0 times the width of phalange (twice width of phalanges in figures III and IV), width of finger III disc 54% of tympanum diameter; first finger longer than second; relative length of figures II = IV < I < III, subarticular tubercles prominent (one in figures I and II, two in III and IV); prominent supernumerary tubercles on fingers III and IV; lateral fringes of fingers to base of discs; ventral callous pad on all fingers from distal edge of proximal subarticular tubercle to base of disc; two palmar tubercles, inner one oval and outer oblong ovate.

Male with gular pouches appearing as small, wrinkled, skin folds at the corners of the jaw and vocal sac openings on floor of mouth at corner. The nuptial pad is a cream-colored, velvety structure covering the medial surface of the first finger from its base to the base of disc, and on the dorsal surface from the base of the finger to the level of the subarticular tubercle; very fine whitish granular on the pad.

Toes long, slender, relative toe lengths I < II < III= V < IV; tips of toes with large, triangulare disks, relative pad size II > III > IV > I > V; ventral circummarginal grooves present; first three toes laterally and fifth toe fully webbed to base of discs; fourth toe fully webbed to base of disc; the lateral fringes on first and fifth toes to base of discs; inner tarsal fold present and outer absent; subarticular tubercles prominent; an oval inner metatarsal tubercle and no outer one.

Dorsal skin on the back smooth except finely granular in posterior part; flank skin granular and spinous and ventral skin smooth except for a granular region under the thighs; dorsolateral fold weak.

Under stereoscope, fine spinules at the following regions: upper jaws and corners of upper jaws, loreal region, tympanic rim, temporal region, anterior margins of forearm near shoulder, posterior margins of metatarsa, dorsal surface of tibia, and fine spinules cluster in center of tympanum. No asperities and tubercles on body; ventrolateral cluster near to the insertion of the arm; fine spinules on throat and chest in an ovoid cluster.

Measurements (mm) of holotype. SVL 51.90; HL 21.01; HW 18.09; SL 9.59; ED 7.92; IOD 4.21; TD 4.47; TED 1.24; TL 34.89; FEM 21.4; HNL 17.16; TL 30.75; FD3 2.41; TD4 2.14.

(HL∶HW = 1.16; SNL∶HL = 0.46; TD∶ED = 0.56; ED∶SL = 0.83; TL∶SVL = 0.67; FD3∶TD = 0.54)

3 Coloration in Life (in preservative)

Dorsal surfaces olive green in life (dark), with a single row of seven nearly round brown (black) spots in midline of back from the interorbitial area to vent, and a small whitish (whitish) spot on the center of head back at the level of anterior corners of eye; a golden (whitish) upper lip strip from tip of snout and along the upper jaws extending to insertion of arm; dark brown (dark gray) loreal region; dark brown (dark gray) band on side of head with a sharp boundary where it meets the lighter dorsal color, band continuing beyond tympanum and temporal region, narrowing behind axilla to form a narrow, dark, ventral border to the dorsolateral line and extending near to vent; dark brown (gray) flanks with yellow (whitish) marbling; tympanum with a dark brown center and pale gray circular; tympanum rim dark brown; venter and pumlar surface of hands pale gray (pale gray); ventral surface of limbs and hands ivory (offwhite); dorsal surface of limbs pale brown with dark brown (dark gray) crossbars and interspersed brown spots and golden or whitish (whitish) flecks circular to the crossbars and distinct blotches to tips of digits.

4 Distribution and Ecology

Rana zhaoi is currently known only from Yarang, Mêdog County, Tibet (Xizang Autonomous Region). Two specimens were collected along small rocky stream in evergreen forest at about 767 m. This frog generally acts on rocks in small stream and under small falls. No information about the egg and tadpoles.

5 Comparison

This new cascade frog, *Odrrana zhaoi*, was reported under the name *R. margaretae* by Zhao et al. (2005). But *O. margaretae* differs from *R. zhaoi* by having tips of outer three figures expanded and no pular pouches (all figuretips expanded and with external subpular pouches in male of *O. zhaoi*).

Although *Odorrana zhaoi* bear the most striking resemblance to *O. graminea*, *O. chloronota* and *O. livida* in having green color dorsally and ventral circummarginal grooves present in the discs of the fingers, *O. zhaoi* distinguishably differs from them with a nuptial spinule cluster on throat and chest. *O. graminea* further differs from *O. zhao* with its nearly vertical (versus concave) loreal region, larger tympanum, smaller hands, larger TD∶ED (0.77 in male), dorsum green with dark smooth sides, whereas *O. chloronota* further differs from *O. zhaoi* in having weak lateral fringes on Ⅰ and Ⅴ to terminal phalanges and disks on fingers greatly enlarged (> 2 × base of phalanges).

Odorrana livida differs from *O. zhaoi* in TD: ED 0.41 (TD∶ED 0.56 in *O. zhaoi*), absence of dorsolataral fold and smooth skin with pustules dorsal to the cloaca (weak dorsolataral fold, smooth dorsum, laterally granular in *O. zhaoi*), rounded head (obtusely pointed in *O. zhaoi*), absence of transverse bars on the limbs (Bain et al., 2003) and disks on fingers enlarged (> 2x base of phalanges). The conspicuous difference is the fine spinous cluster in ovoid shape on throat and chest in *R. zhaoi* (absence of such characters in *O. livida* under the observation of the specimens from CIB and SYNU).

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Appendix-specimens examined

Rana graminea (28). China, Fujian Province (as Fukien Province): (males) CIB 51780, 51782, 51783, 51788, 51786, 51790, 51792, 51795; (female) 51787. Hainan Provicne: (males) CIB 51875, 51876, 51878, 51880, 51884, 51892, 51901, 51906, 51916, 51919, 51933, 51936, 51946, 51948, 51951, 51956, 51958, 51959, 51961. These specimens labeled as *Rana livida* in CIB and recognized as *R. graminea* according Bain et al. (2003). *R. livida* (25). China Guangxi Zhuangzhu Autonomous Region (as Kawsien): (females) CIB 51865, 51866, 51867, 51868, 51869. Anhui Province: (females) CIB51870, 51871, 51872, 51873. Sichuan

Province: (males) SYNU 6700, 6713, 7056, SYNU-Hui040015. Yunnan Province: (males) KIZ 77I0182, 77I0183, 79051, 79053, 79054, 79055, 79073; (females) KIZ 77I0184, 79050, 79059, 79074, 79075. *R. margaretae* (4). China Sichuan, Zhejiang and Anhui Provinces: (males) SYNU 6701, 6702, 6703; (female) 6704. 9 specimens of *R. livida* (4 males and 5 females) were examined from the deposited bottle marked 350050 7# (11A-2) in KIZ.

REFERENCES

Bain, R. H., Lathrop, A., Murphy, R. W., Orlov, N. L. and Ho, T. C. 2003. Cryptic species of a cascade frog from Southeast Asia: taxonomic revisions and descriptions of six new species. *Am. Mus. Novit.*, 3 417:1-60.

Bain, R. H. and Nguyen, Q. T. 2004. Herpetological diversity of Ha Giang Province in northeastern Vietnam, with descriptions of two new species. *Am. Mus. Novit.*, 3 453:1-42.

Bain, R. H., Stuart, B. L. and Orlov, N. L. 2006. Three new Indochinese species of cascade frogs (Amphibia: Ranidae) allied to *Rana archotaphus*. *Copeia*, 2006: 43-59.

Chen, L-Q, Murphy, R. W., Lathrop, A., Ngo, A., Orlov, N. L., Ho, C. T. and Somorjai, I. 2005. Taxonomic chaos in Asian ranid frogs: an initial phylogenetic resolution. *Herpetol. J.*, 15: 231-243.

Fei, L, Ye, C-Y, Jiang, J-P, Xie, F and Huang, Y-Z 2005. An Illustrated Key to Chinese Amphibians. Sichuan Publishing Group-Sichuan Publishing House of Science and Technology, Chengdu. 1-340.

Frost, D. R. 2007. Amphibian Species of the World 5. 1, an Online Reference. http://research. amnh. org/herpetology/amphibia/index. php

Frost, D. R., Grant, T., Faivovich, J. *et al*. 2006. The American tree of life. *Bulletin of the American Museum of Natural History*, 297: 1-370.

Hu, S-Q 1987. Amphibian-Reptilia of Xizang. Science Press, Beijing. 1-167.

Inger, R. F. 1976 Commentary on a proposed classification of the family Ranidae. *Herpetologica*, 52: 241-246.

Inger, R. F. and Chanard, T. 1997. A new species of ranid frog from Thailand, with comments on *Rana livida* (Blyth). *Nat. Hist. Bull. Siam Soc.*, 45: 65-70.

International Commission on Zoological Nomenclature, 1999. International Code of Zoological Nomenclature, 4th ed. The International Trust for Zoological Nomenclature, London.

Jiang, J-P and Zhou, K-Y 2005. Phylogenetic relationships among Chinese ranids: Inferred from sequence data set of 12S and 16S rDNA. *Herpetological Journal*, 15: 1-8.

Li, P-P, Lu, Y-Y, Li, J-L, Zhao, H, Hou, M and Zhang, M-W 2005. Herpetological surveys of Xizang Autonomous Region: 1. from Lhasa to Zayü and Mêdog 62 K. *Sichuan J. Zool.*, 24: 245-249.

Liu, C-C and Hu, S-Q 1961. Tailless Amphibians of China. Science Press, Beijing. 1-364.

Li, P-P 2007. Description of a new subspecies of *Crytodactylus khasiensis* from China. *Acta Zootaxonomica Sinica*, 32: 733-737. [动物分类学报]

Mittermeter, R. A. 1999. Hotspots: Earth's Biodiversity Riches and most Endangered Terrestrial Ecologions. Cemex, S. A. & Conservation International, Mexico City.

Ngo, A., Murphy, R. W., Liu, W-Z, Lathrop, A. and Orlov, N. L. 2006. The Phylogenetic relationships of the Chinese and Vietnamese waterfall frogs of the genus *Amolops*. *Amphibia-Reptilia*, 27: 81-92.

Orlov, N., Le, N. N. and Ho, T. C. 2003. A new species of cascade frog from north Vietnam (Ranidae, Anura). *Russ. J. Herp.*, 10: 123-134.

Stuart, B. L., Orlov, N. L. and Chan-ard, T. 2005. A new cascade frog (Amphibia: Ranidae) from Laos and Vietman. *The Raffles Bulletin of Zoology*, 53: 125-131.

Yang, D-T 1991. Phylogenetic systematics of the Amolops group of ranid frogs of southeastern Asia and the Greater Sunda Islands. *Fieldiana*, 63: 1-42.

Yang, J, Wen, X-M and Yuan, H 2005. Herpetological surveys of Xizang Autonomous Region: 3. from Ürümqi to Lhasa. *Sichuan J. Zool.*, 24: 254-259.

Zhao, W-G, Rao, D-Q, Lü, S-Q and Dong, B-J 2005. Herpetological surveys of Xizang Autonomous Region, 2. Mêdog. *Sichuan J. Zool.*, 24: 250-253.

西藏湍流蛙类一新种

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摘　要　在西藏墨脱采集到1种与 *Odorrana graminea*、*O. chloronota* 和 *O. livida* 体背绿色和指端膨大具沟的湍流蛙类相近的物种，经鉴定为新种，命名为墨脱臭蛙 *Odorrana zhaoi*。新种具有以下主要特征：上唇缘具有金黄色条纹；鼓膜圆形，显著，TD：ED为0.56；背侧褶弱，背部皮肤除后部有小疣粒外光滑，体侧有疣粒和小刺；4肢背面有横斑纹；无外蹠突；雄性具1对外声囊和咽胸部椭圆形小刺团，无肱腺。

关键词　蛙科，臭蛙属，新种，中国.

中图分类号　Q959.53